FOREST INSECT AND DISEASE MANAGEMENT

Control of Overwintering Native Elm Bark Beetles by Application of Dursban® 4E to Elm Trees

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NA-FB/P-6

Northeastern Area, State & Private Forestry, U.S. Department of Agriculture
Broomall, PA 19008
November 1980

INTRODUCTION

Since the spread of Dutch elm disease, *Ceratocystis ulmi* (Buism.) C. Moreau, to the northern latitudes, the native elm bark beetle, *Hylurgopinus rufipes* (Eichh), has been the major vector of this disease in the northern United States and Canada (Kaston 1939, Watson and Sippel 1961, Baker 1972, Kondo et al. 1972, Thomas 1972, Gardiner 1977). The distribution of the native elm bark beetle follows the natural range of the American elm, *Ulmus americana* (L.), in North America.

The beetle has one and one-half generations per year in its northern range; it overwinters in both the adult (Brood A) and larval stages (Brood B). Adults enter the bark of the lower trunk of the tree to form hibernation cells in late August and early September (Fig. 1).

Methoxychlor is registered for elm bark bettle control by ground application with mist blower or hydraulic sprayer at 12.5-percent and 2-percent concentrations, respectively. These broadcast-type applications are not environmentally acceptable and have not always given satisfactory control of beetle populations (Al-Azawi and Norris 1959). Gardiner (1977) field tested several newer insecticides and found that chlorpyrifos, Dursban® 4E,[1] gave the best results for control of overwintering adults of the native elm bark beetle in the area of Sault Ste. Marie, Ontario, Canada.

OBJECTIVE

The objective of this pilot project[2] was to evaluate the effectiveness of an application of Dursban 4E to elm tree trunks for control of overwintering adult native elm bark beetles.

METHODS

Location

The pilot project was conducted in Houghton and Ontonagon Counties of the Upper Peninsula, Michigan. The treatment plots were located every 5 miles along U. S. Route 41 (4 plots) between the Sturgeon River and the city of Hancock and along Michigan Route 26 (11 plots) between Hancock and Ontonagon. Each plot contained one to several pairs of American elm trees selected for study. The number of pairs per plot was based on the number of native elm bark beetles caught on pheromone (Multilure) sticky traps in the spring of 1978 (Fig. 2, Table 1). The trees selected for each pair were as comparable as possible in size, (diameter at breast height) vigor, and exposure of infestation.

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[1] The use of trade, firm, or corporation names in this paper is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

[2] The work reported herein was funded in whole or part by a U.S. Department of Agriculture, Forest Service Cooperative Agreement 42-281.

Figure 1. — Seasonal life cycle of the native elm bark beetle in its northern range.

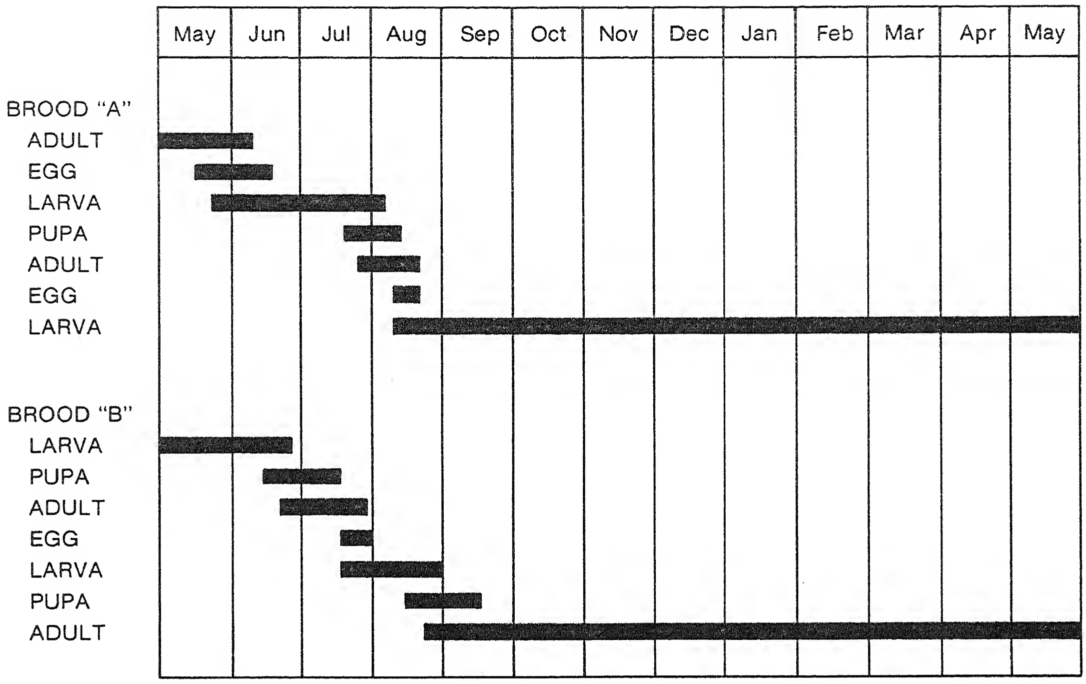

Figure 2. — Native elm bark beetles trapped in each plot, Houghton and Ontonagon Counties, Michigan, May 1979.

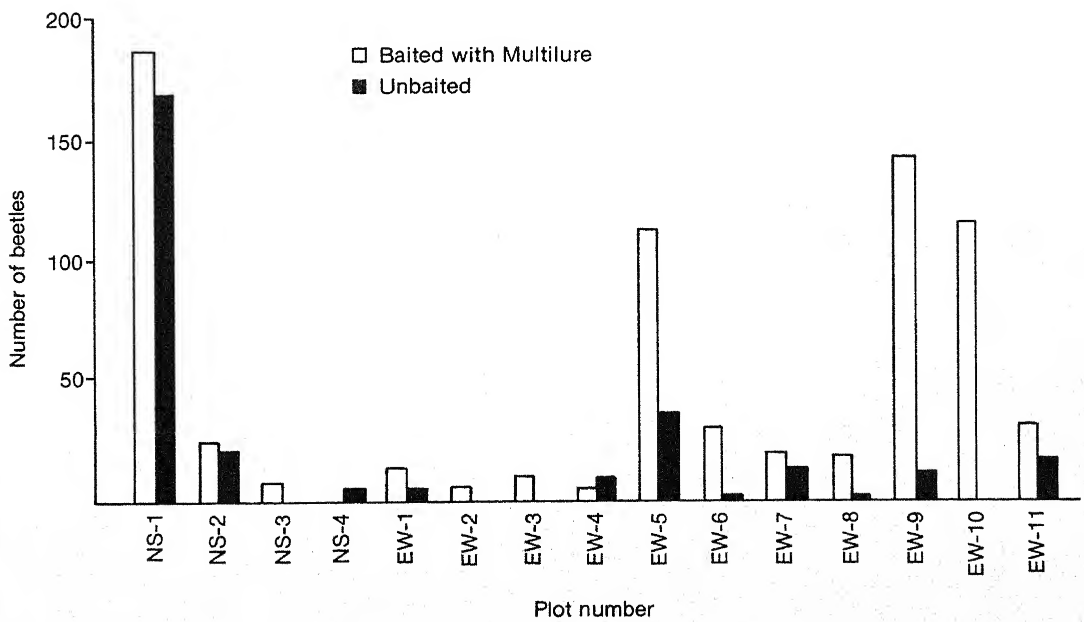

Table 1. — Number of native elm bark beetles trapped per plot and number of trees sprayed

Plot number	Number of beetles trapped	Number of trees sprayed[a]
NS-1	189	13
NS-2	21	2
NS-3	5	1
NS-4	1	1
Total	216	17
EW-1	11	1
EW-2	2	1
EW-3	5	1
EW-4	2	1
EW-5	109	7
EW-6	26	2
EW-7	13	1
EW-8	10	1
EW-9	138	9
EW-10	111	7
EW-11	25	2
Total	452	33
Total	668	50

[a] $$\text{Number of spray trees per plot} = \frac{\text{Number of beetles per trap}}{\text{Total number of beetles trapped}} \times 50$$

All trees had no visible symptoms of Dutch elm disease at the time of ›lection. One tree of each pair was randomly selected for insecticide ›atment; the other tree was an untreated control. The control trees were ther far enough away from the spray trees or were protected with plastic to ›event contamination.

›eatment

A 0.5-percent emulsion concentration of Dursban 4E (4 lb AI/gal) was ›plied by backpack mist blower to the basal 2 m (6.56 ft) of each of the 50 ›es selected for treatment. Sufficient spray was applied to thoroughly wet e entire bark surface. Trees were treated during the first week of August.

›aluation

Two methods were used to evaluate the treatment.

1. *Fall boring dust counts.* — In October, after the adult beetles had entered hibernation, counts of the boring dust piles produced by the beetles entering the bark were made on most plot trees. A band 25 cm (9.8

inches) wide around the tree at 1.25 m (4.1 ft) above ground was used as the sample unit. Counts were converted to the number of dust piles per square centimeter.

2. *Adult emergence.* — The spring-emerging adult beetles were counted by using a 25-cm sticky trap fixed around each tree at the 1.25-m height (Gardiner 1977). Counts of trapped beetles were completed in late June or early July and converted to the number of beetles per square centimeter.

RESULTS

Beetle entry into the trunk of the tree as determined by boring dust counts was significantly ($p=.01$) reduced by the insecticide application (Table 2). Treated trees had an 88.4-percent reduction over the control trees. Essentially the same reduction, 88.5-percent, was obtained between treated and control trees according to beetle emergence data collected in the spring (Fig. 3, Table 3).

Table 2. — Native elm bark beetle dust boring counts for treated and control trees expressed as average number of dust piles per $cm^2 \times 10^{-4}$, October 1978

Plot number	Treated trees	Control trees
NS-1	6.07	61.31
NS-2	0	0
NS-3	a	a
NS-4	0	0
EW-1	a	a
EW-2	a	a
EW-3	0	6.90
EW-4	a	a
EW-5	7.96	3.99
EW-6	0	0
EW-7	0	0
EW-8	0	42.80
EW-9	0	2.23
EW-10	0	1.46
EW-11	0	2.15
Total	14.03	120.84
Percent reduction		88.4

[a] Data not collected because of early deep snow.

Figure 3. — Native elm bark beetles trapped at each plot, Houghton and Ontonagon Counties, Michigan, July 1979

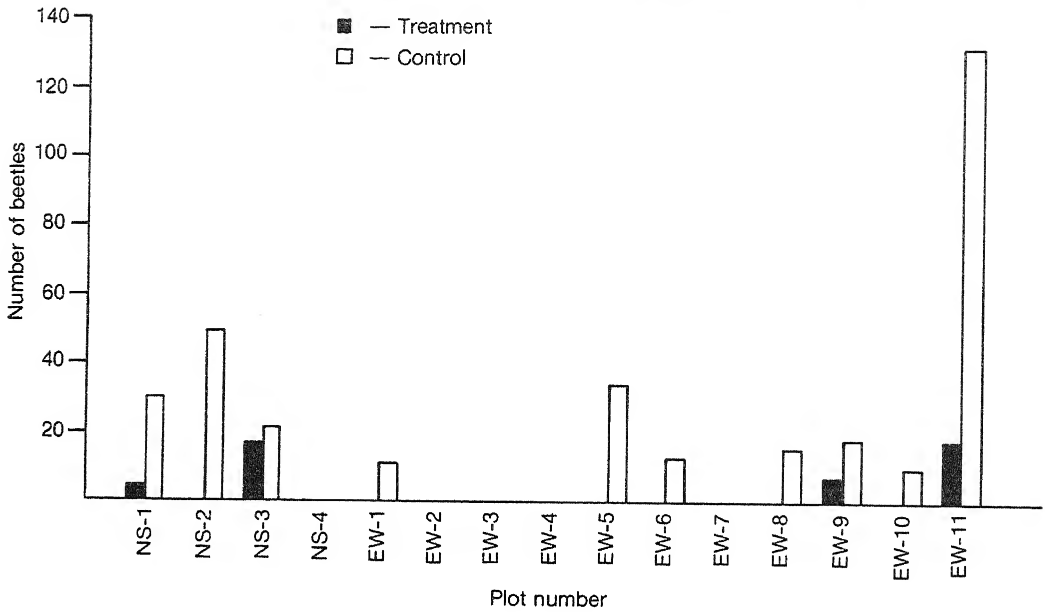

Table 3. — Adult beetle emergence counts on treated and control trees, July 1979

	Average number of beetles per cm² x 10^{-4}	
Plot number	Treated trees	Control trees
NS-1	2.53	28.94
NS-2	0	45.23
NS-3	16.24	16.33
NS-4	0	0
EW-1	0	8.24
EW-2	0	0
EW-3	0	0
EW-4	0	0
EW-5	0	24.79
EW-6	0	8.27
EW-7	0	0
EW-8	0	12.44
EW-9	2.76	12.88
EW-10	0	4.72
EW-11	12.25	131.10
Total	33.78	292.94
:tion		88.5

DISCUSSION & CONCLUSION

The topical application of Dursban 4E to the basal 2m of elm trees was effective in preventing successful beetle overwintering in the trunks of healthy elms. The treatment actually reduced the population rather than repelling it. On several of the plots dead beetles were found that had bored into the tree and died before they completely entered the bark. The treatment trees showed good control, except in one plot. In this case the trees may have had an overwintering larval population in the bark before spraying took place, and when the traps were set the beetles caught were newly emerging adults rather than emerging overwintering adults.

This method of application provides a quick, effective, and economical means of controlling the native elm bark beetle. Fifty trees were sprayed with one-half gallon of Dursban concentrate. It took approximately 1 minute to treat each tree. In an urban environment or a pure stand of elm it would be relatively economical to apply Dursban 4E to healthy trees. Registration has been approved for use of this chemical for native elm bark beetle control.

RECOMMENDATIONS

Further testing should be conducted to determine the minimum concentration of Dursban 4E that will provide control of overwintering beetle population and the duration of residual deposit effectiveness.

The treatment should be incorporated into Dutch elm disease control programs where the native elm bark beetle is the major vector of the disease.

LITERATURE CITED

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PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key — out of the reach of children and animals — and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and burn them in a level isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the Federal Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

PROTECT

Use Pesticides Safely

FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE